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(54) **Brush holder for dynamoelectric machines.**

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EP-A- 0 101 546
EP-A- 0 139 450
EP-A- 0 148 702
US-A- 4 293 789

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EP 0 236 254 B1

Description

This invention relates to a brush holder for dynamoelectric machines, the brush holder securing brushes in the machines during assembly and thereafter. More particularly the present invention applies to motors and generators utilizing brushes wherein it is desirable to have a brush holder to secure the brushes in a position which facilitates assembly and which facilitates automated assembly.

The brush riggings for motors and generators and the like vary in design, but in general consist of boxes to house the brushes, a spring means to apply pressure to the brushes to urge them against a commutator, connecting electrical leads to provide a current path to the brushes and a mounting surface to secure these elements as well as to provide some means to secure the entire assembly to the motor in such a manner as to place the brushes in a proper working relationship with the commutator.

One of the most popular designs, especially for small fractional horsepower motors, is to utilize a molded brush card member of a one-piece construction formed from a high temperature resistant plastic. The member has the brush boxes formed thereon as well as various openings for securing it to the motor housing and for receiving an extending armature shaft and the commutator secured to the shaft.

The prior riggings present problems when they are contemplated for use in an automated assembly process. In particular, while assembling the armature in a motor, complicated movements would have to be performed by the automation equipment to hold the brushes back in the brush box against the pressure being applied to the brushes by the spring means until such time as the commutator is positioned to receive the brushes.

Although this is particularly a problem for automated assembly of motors, it also applies to those units being assembled by hand in that special tools and fixtures have previously been used to hold the brushes while the armature is being assembled. The brush holder as described herein would avoid the need for this equipment.

In US-A-4,293,789 which discloses the prior art according to the precharacterizing portion of independent claims 1 and 7 brush holders are attached to a motor end cap and a separate displaceable section acts to secure the brushes within the brush box until such time as the armature is assembled thereto. The displaceable section is designed such that upon assembly, the armature of the motor acts to displace the displaceable section thereby releasing the brushes and allowing the brush springs to urge the brushes against the commutator.

Reference is also made to EP-A-0 139 450 which discloses an electric motor having brush holders attached to the stator body and having integral hooked extensions to retain the brushes in a mounting position. The hooked extension are bent up into a release position after assembly of the motor to allow the brushes to move into contact with the commutator.

The object of the invention is to provide a brush holder for a dynamoelectric machine that allows for a safe, economical, easy and reliable automated assembly of the dynamoelectric machine.

This object is achieved according to one form of the invention by the provision of a brush holder for a dynamoelectric machine having an armature including an armature shaft and a commutator, said brush holder having two cavities for receiving and positioning a respective brush and a displaceable section adapted to releasably secure the brushes in said cavities in a mounting position, said displaceable section being positioned to be contacted by a portion of said commutator during insertion of said armature shaft into said brush holder to displace said displaceable section and release said brushes to engage said commutator, characterized in that said displaceable section is integrally connected to said brush holder by rupturable tabs.

The above object is also achieved according to another form of the invention by the provision of a brush holder for a dynamoelectric machine having an armature including an armature shaft and a commutator, said brush holder having two cavities for receiving and positioning a respective brush and a displaceable section adapted to releasably secure the brushes in said cavities in a mounting position, said displaceable section being positioned to be contacted by a portion of said commutator during insertion of said armature shaft into said brush holder to displace said displaceable section and release said brushes to engage said commutator, characterized in that said displaceable section is integrally connected to said brush holder by two flexible fingers adapted to be deflected upon contact of said displaceable section by said commutator portion.

Several embodiments are disclosed herein with the displaceable section being designed for varying purposes in each. In one embodiment the displaceable section is a washer-like member which serves as a thrust washer and/or an oil slinger on the armature shaft after it is displaced to release the brushes.

Another embodiment discloses breakaway sections which merely fall to the bottom of the motor housing after they are displaced. A third embodiment discloses fingers which are bent relative to

the brush holder as the armature is assembled.

The brush holder will now be described in greater detail with reference to the accompanying drawings, wherein:

Figure 1 is a sectional view of a dynamoelectric machine showing the position of various components therein including a brush holder in accordance with one embodiment of the invention.

Figure 2 is a perspective view of the brush holder as shown in Figure 1 prior to assembly into the motor.

Figure 3 is a sectional view of a dynamoelectric machine showing the position of various components therein including a brush holder in accordance with another embodiment of the invention.

Figure 4 is a perspective view of the brush holder as shown in Figure 3 prior to assembly into the motor.

Figure 5 is a sectional view of a dynamoelectric machine showing the position of various components therein including a brush holder in accordance with another embodiment of the invention.

Figure 6 is a perspective view of the brush holder as shown in Figure 5 prior to assembly into the motor.

Figure 7 is a sectional view of a means for connecting a conductor to a brush and for securing this assembly to the brush card.

The invention will be described herein relative to small fractional horsepower motors which are designed to facilitate assembly. It is to be understood that this invention has like applicability to other types of dynamoelectric devices which utilize brushes and to various-sized devices and to motors which are ~~manually assembled~~.

Referring to Figure 1, there is shown a dynamoelectric machine which is a motor having a housing 1 with permanent magnets 2 secured therein. Armature 3 is supported to rotate within the housing by bearings 4 and 5. A brush card 6 defines brush card boxes having cavities 7 and 8 which hold and position brushes 9 and 10. The brushes are held in the cavities for reciprocating motion. Brush springs 18 and 19 are positioned to urge the brushes 7 and 8 inwardly against commutator 11 of the armature after the motor is assembled. In this position, current is supplied from conductors 12 and 13 through the brushes to the commutator to windings 15 of the armature. The brush card is made from an electrically nonconductive material such as plastic.

Washer 14 is shown positioned on the armature on shaft 60 between the commutator and bearing 4 and serves as a thrust washer during motor operation. The washer further serves to control end play of the armature by eliminating axial slack between the armature and the housing. Prior to assembly, washer 14 was an integral portion of the brush card as may be seen in Figure 2.

Referring now to Figure 2, there may be seen brush card 6 which in a cutaway portion shows brush box cavity 7 in which brush 9 is mounted for reciprocating motion. Brush spring 18 is shown for urging brush 9 inwardly. Conductors 12 and 13 are shown connected to the appropriate brush.

At the center of brush card 6 there may be seen washer 14. Washer 14 is cylindrical in configuration having center opening 16 sized to the received armature shaft 60. About the exterior of washer 14 are located circumferentially-extending slots 42 which, together with washer 14 and remainder of brush card 6 serve to define tabs 40 which secure washer 14 to the remainder of brush card 6. Slots 42 at the radially-outward circumference define commutator opening 44. Commutator opening 44 is sized to allow commutator 11 to be inserted therein.

Washer 14 is shown in the mounting position wherein it serves to block the inward displacement of brush 9 in Figure 2. Once shaft 60 is inserted through opening 16 during assembly, the armature is then in position for being displaced to separate the washer from the remainder of the brush card. Once the commutator engages the washer during assembly, the tabs break and the washer is displaced to the position shown in Figure 1 between the commutator and bearing 4. Once the washer is displaced, there is no longer an exterior or shelf surface 17 of the washer which prevents the brush from being urged inwardly. Hence, as the washer is displaced, the spring urges the brush inwardly to engage the exterior surface of commutator 11 as is desired.

Referring now to Figure 7, the detail of one means for securing the brush relative to the housing is disclosed. Therein it may be seen that the cavity that holds the brush is formed in such a manner as to receive the brush assembly at the outer end of the cavity and after insertion, the brush is captured between one end of a spring and surface 17 of the washer (not shown). The other end of the spring rests against the cavity end closure means and is preferably a metal connector plate 22 to which brush shunt 20 and conductor 12 are secured. Figure 7 specifically shows an arrangement where conductor 12 is inserted through grommet 21 secured within housing 1 of the motor. Conductor 12 is secured to plate 22 by solder or by mechanically crimping brush shunt 20 that extends up through brush spring 18 to connector plate 22. Shunt 20 forms an electrical connection between conductor 12 and brush 9. Plate 22 provides convenient means to make electrical connection between the outside conductor and a brush shunt. Further the plate provides a stop means for the brush spring which will be in the compressed

state as it urges the brush towards the center of the brush card. As may be seen in Figure 7, a connector plate tab 23 is provided for engaging lip 24 of the brush box defined by the card member such that the connector plate may be secured thereto. This is but one arrangement of securing a brush and making electrical connection thereto. Other similar arrangements are well known.

Figure 2 again shows the brush holder assembly prior to assembly into the motor. During assembly operation, armature shaft 60 is inserted into opening 16 of the brush card. The diameter of the opening is preferably such that a slip fit exists between the shaft and opening 16 of the washer. As the shaft slips through the opening, the radially-extending face of the commutator comes into contact with the washer, and, as the pressure is applied by the motor assembly equipment, the washer breaks away from the brush card and travels with the commutator as the assembly operation of the motor continues. The washer now rests against the face of the commutator and may serve as a thrust surface for the armature during axial loading and may serve to control end play or axial movement of the armature within the motor housing. Another important function of the washer is to sling oil that characteristically seeps from oil impregnated bearing 4 or from other external sources to prevent that oil from creeping down the armature shaft and contaminating the brushes. Heretofore, often a separate washer was of necessity pressed onto the shaft to sling the oil off the shaft before it reached the brushes. It has been found that oil causes the brushes to gum up and stick in the brush boxes or causes other electrical problems between the brushes and the commutator which cannot be tolerated if effective motor operation is required.

Figure 3 shows an alternative embodiment wherein brush card 25 is substituted for brush card 6 of Figure 1. The remaining elements of the basic motor are labeled the same and are identical to the elements in Figure 1. Brush card 25 is formed with a plurality of breakaway sections 26 each having a step portion 27 that functions as a shelf upon which brushes 8 and 9 rest prior to assembly. In contrast to the embodiment as shown in Figure 1 however, this brush card provides for the step section to be broken away by the commutator during assembly such that the breakaway section separates into several pieces as shown in Figure 3. These broken-away pieces fall harmlessly into a space between the brush card and end cap 28 of the motor and do not interfere with operation of the motor.

Referring now to Figures 5 and 6, there may be seen yet another embodiment of the herein invention. As in Figure 3 the housing and motor parts of Figure 5 are the same as those shown in Figure 1. Brush card 29 in Figures 5 and 6 includes a pair of projecting fingers 30 and 31, each of which has a projection 34 and 36 which extends inwardly and includes a contact surface 32 and 33 to engage respective brushes 9 and 10 to secure them in a mounting position. Projections 36 and 34 extend inwardly and at contact surfaces 32 and 33 engage the brushes such that the springs may not urge the brushes inwardly.

Upon assembly of the motor armature the radially-extending face of the commutator engages the projections and displaces them to the left as shown in Figure 5. As the projections are displaced to the left, the fingers are bent and the retention of the brushes in the mounting position is released. The brush springs then urge the brushes inwardly to engage the commutator surface in the desired final configuration as shown in Figure 5. Depending upon the strength and size of the fingers they may act to absorb some axial load exerted by the face of the commutator against the fingers when the motor is operated.

Claims

1. Brush holder for a dynamoelectric machine (1) having an armature (3) including an armature shaft and a commutator (11), said brush holder having two cavities (7, 8) for receiving and positioning a respective brush (9, 10) and a displaceable section (14) adapted to releasably secure the brushes (9, 10) in said cavities (7, 8) in a mounting position, said displaceable section being positioned to be contacted by a portion of said commutator (11) during insertion of said armature shaft into said brush holder to displace said displaceable section and release said brushes (9, 10) to engage said commutator, characterized in that said displaceable section is integrally connected to said brush holder by rupturable tabs (40).

2. Brush holder according to claim 1, characterized in that said displaceable section comprises a washer-like portion (14) of the brush holder, said washer-like portion (14) defining a center opening (16) sized to receive the armature shaft therethrough and said washer-like portion (14) and said brush holder defining circumferential slots (42) spaced about said washer-like portion (14) and defining said rupturable tabs (40) therebetween.

3. Brush holder according to claim 1, characterized in that after separation form said brush holder said washer-like portion (14) is adapted to serve as an oil slinger positioned on said

armature shaft to prevent oil that collects on the armature shaft from reaching the commutator (11) and brush (9, 10).

4. Brush holder according to claim 1, characterized in that said washer-like portion (14) is sized to serve as a thrust surface for said armature (3) after separation from said brush holder.

5. Brush holder according to claim 3, characterized in that said circumferential slots (42) are sized to define a commutator opening (44) into which the commutator (11) of the armature shaft is adapted to be inserted.

6. Brush holder according to claim 1, characterized in that said displaceable section comprises at least one breakaway section (26), and that said brush holder and said breakaway section (26) define breakaway cavities such that during insertion of said armature shaft into said brush holder the breakaway section (26) is separated from said brush holder and the breakaway cavities and the area occupied previously by said breakaway section (26) collectively define a commutator opening (44) into which the commutator (11) is adapted to be inserted.

7. Brush holder for a dynamoelectric machine (1) having an armature (3) including an armature shaft and a commutator (11), said brush holder having two cavities (7, 8) for receiving and positioning a respective brush (9, 10) and a displaceable section adapted to releasably secure the brushes (9, 10) in said cavity (7, 8) in a mounting position, said displaceable section (34, 36) being positioned to be contacted by a portion of said commutator (11) during insertion of said armature shaft into said brush holder to displace said displaceable section and release the brushes to engage said commutator, characterized in that said displaceable section is integrally connected to said brush holder by two flexible fingers (30, 31) adapted to be deflected upon contact of said displaceable section by said commutator portion.

8. Brush holder according to claim 7, characterized in that said displaceable section comprises an inwardly extending projection (34, 36) on said fingers (30, 31) which defines a contact surface (32, 33) positioned to retain the brushes (9, 10) until such time the fingers (30, 31) are deflected.

9. Brush holder according to anyone of claims 1 to 8, characterized in that said brush holder is fabricated from electrically nonconductive material.

10. Brush holder according to anyone of claims 1 to 9, characterized in that the brush holder comprises a brush card (6; 25; 29) to which said displaceable section is integrally secured and that said brush cavities (7, 8) are defined by a brush box integrally formed with said brush card (6; 25; 29).

Patentansprüche

1. Bürstenhalter für eine dynamoelektrische Maschine (1), die einen Anker (3) mit einer Ankerwelle und einem Kommutator (11) hat, wobei der Bürstenhalter zwei Hohlräume (7, 8) zum Empfangen und Positionieren einer Bürste (9, 10) und einen verlagerbaren Abschnitt (14) zum lösbaren Befestigen der Bürsten (9, 10) in den Hohlräumen (7, 8) in einer Montageposition hat, wobei der verlagerbare Abschnitt so positioniert ist, daß er mit einem Teil des Kommutators (11) während des Einführens der Ankerwelle in den Bürstenhalter in Kontakt kommt, um den verlagerbaren Abschnitt zu verlagern und die Bürsten (9, 10) freizugeben, damit diese mit dem Kommutator in Berührung gelangen, dadurch gekennzeichnet, daß der verlagerbare Abschnitt mit dem Bürstenhalter durch zerbrechbare Lappen (40) integral verbunden ist.

2. Bürstenhalter nach Anspruch 1, dadurch gekennzeichnet, daß der verlagerbare Abschnitt einen scheibenartigen Teil (14) des Bürstenhalters aufweist, wobei der scheibenartige Teil (14) eine mittlere Öffnung (16) aufweist, die zum Aufnehmen der Ankerwelle bemessen ist, und daß der scheibenartige Teil (14) und der Bürstenhalter Umfangsschlitze (42) bilden, die mit Abstand um den scheibenartigen Teil (14) angeordnet sind und zwischen sich die zerbrechbaren Lappen (40) bilden.

3. Bürstenhalter nach Anspruch 1, dadurch gekennzeichnet, daß der scheibenartige Teil (14) nach dem Abtrennen von dem Bürstenhalter in der Lage ist, als ein Ölschleuderring zu dienen, der auf der Ankerwelle angeordnet ist, um Öl, das sich auf der Ankerwelle sammelt, daran zu hindern, den Kommutator (11) und die Bürste (9, 10) zu erreichen.

4. Bürstenhalter nach Anspruch 1, dadurch gekennzeichnet, daß der scheibenartige Teil (14)

so bemessen ist, daß er als eine Axialdruckfläche für den Anker (3) nach der Abtrennung von dem Bürstenhalter dient.

5. Bürstenhalter nach Anspruch 3, dadurch gekennzeichnet, daß die Umfangsschlitze (42) so bemessen sind, daß Sie eine Kommutatoröffnung (44) bilden, in die der Kommutator (11) der Ankerwelle eingeführt werden kann.

6. Bürstenhalter nach Anspruch 1, dadurch gekennzeichnet, daß der verlagerbare Abschnitt wenigstens einen Wegbrechabschnitt (26) umfaßt und daß der Bürstenhalter und der Wegbrechabschnitt (26) Wegbrechhohlräume bilden, so daß während des Einführens der Ankerwelle in den Bürstenhalter der Wegbrechabschnitt (26) von dem Bürstenhalter getrennt wird und die Wegbrechhohlräume und der Bereich, der zuvor durch den Wegbrechabschnitt (26) eingenommen worden ist, gemeinsam eine Kommutatoröffnung (44) bilden, in die der Kommutator (11) eingeführt werden kann.

7. Bürstenhalter für eine dynamoelektrische Maschine (1), die einen Anker (3) hat, der eine Ankerwelle und einen Kommutator (11) aufweist, wobei der Bürstenhalter zwei Hohlräume (7, 8) zum Empfangen und Positionieren einer Bürste (9, 10) und einen verlagerbaren Abschnitt hat, der dazu dient, die Bürsten (9, 10) in dem Hohlraum (7, 8) in einer Montageposition lösbar festzuhalten, wobei der verlagerbare Abschnitt (34, 36) so positioniert ist, daß er mit einem Teil des Kommutators (11) während des Einführens der Ankerwelle in den Bürstenhalter in Kontakt kommen kann, um den verlagerbaren Abschnitt zu verlagern und die Bürsten freizugeben, damit diese mit dem Kommutator in Berührung kommen, dadurch gekennzeichnet, daß der verlagerbare Abschnitt mit dem Bürstenhalter durch zwei flexible Finger (30, 31) integral verbunden ist, die so ausgebildet sind, daß sie gebogen werden, wenn der verlagerbare Abschnitt durch den Kommutatorteil berührt wird.

8. Bürstenhalter nach Anspruch 7, dadurch gekennzeichnet, daß der verlagerbare Abschnitt einen sich einwärts erstreckenden Vorsprung (34, 36) an den Fingern (30, 31) aufweist, der eine Kontaktfläche (32, 33) bildet, die so positioniert ist, daß sie die Bürsten (9, 10) so lange hält, bis die Finger (30, 31) gebogen werden.

9. Bürstenhalter nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß der Bürstenhalter aus elektrisch nichtleitfähigem Material hergestellt ist.

10. Bürstenhalter nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß der Bürstenhalter eine Bürstenkarte (6; 25; 29) aufweist, an der der verlagerbare Abschnitt integral befestigt ist, und daß die Bürstenhohlräume (7, 8) durch einen Bürstenkasten gebildet sind, der integral mit der Bürstenkarte (6; 25; 29) ausgebildet ist.

Revendications

1. Porte-balais pour une machine électrique tournante (1) comportant un rotor (3) comprenant un arbre de rotor et un collecteur (11), ce porte-balais ayant deux logements (7,8) pour recevoir et mettre en position un balai respectif (9,10), et une section déplaçable (14) adaptée de manière à fixer d'une manière libérable les balais (9,10) dans les logements (7,8), dans une position de montage, cette section déplaçable étant placée de manière à être rencontrée par une partie du collecteur (11) pendant l'insertion de l'arbre du rotor à travers le porte-balais, afin de déplacer cette section déplaçable et de libérer les balais (9,10) pour qu'ils viennent en contact avec le collecteur, caractérisé en ce que cette section déplaçable est reliée d'une manière intégrale au porte-balais par l'intermédiaire de pattes (40) pouvant être rompues.

2. Porte-balais suivant la revendication 1 caractérisé en ce que la section déplaçable est constituée par une partie (14) du genre rondelle du porte-balais, cette partie (14) du genre rondelle définissant une ouverture centrale (16) dimensionnée de manière à recevoir à travers elle l'arbre du rotor, la partie (14) du genre rondelle et le porte-balais définissant des fentes circonférentielles (42), qui sont espacées autour de la partie (14) du genre rondelle et qui définissent entre elles les pattes (40) pouvant être rompues.

3. Porte-balais suivant la revendication 1 caractérisé en ce qu'après sa séparation à partir du porte-balais la partie (14) du genre rondelle est adaptée de manière à servir en tant que collet de barbotage monté sur l'arbre du rotor de manière à empêcher que l'huile qui est collectée sur l'arbre du rotor, ne puisse atteindre le collecteur (11) et les balais (9,10).

4. Porte-balais suivant la revendication 1 caractérisé en ce que la partie (14) du genre rondelle est dimensionnée de manière à servir en tant

que surface de poussée pour le rotor (3), après sa séparation à partir du porte-balais.

5. Porte-balais suivant la revendication 3 caractérisé en ce que les fentes circonférentielles (42) sont dimensionnées de manière à définir une ouverture de collecteur (44) dans laquelle le collecteur (11) de l'arbre du rotor peut être inséré.

6. Porte-balais suivant la revendication 1 caractérisé en ce que la section déplaçable comprend au moins une section détachée (26) et en ce que le porte-balais et cette section détachée (26) définissent des cavités ajourées de telle façon que, pendant l'insertion de l'arbre du rotor dans le porte-balais, la section détachée (26) soit séparée totalement du porte-balais et que les cavités ajourées et la surface occupée antérieurement par la section détachée (26) définissent conjointement une ouverture de collecteur (44) par laquelle peut être introduit le collecteur (11).

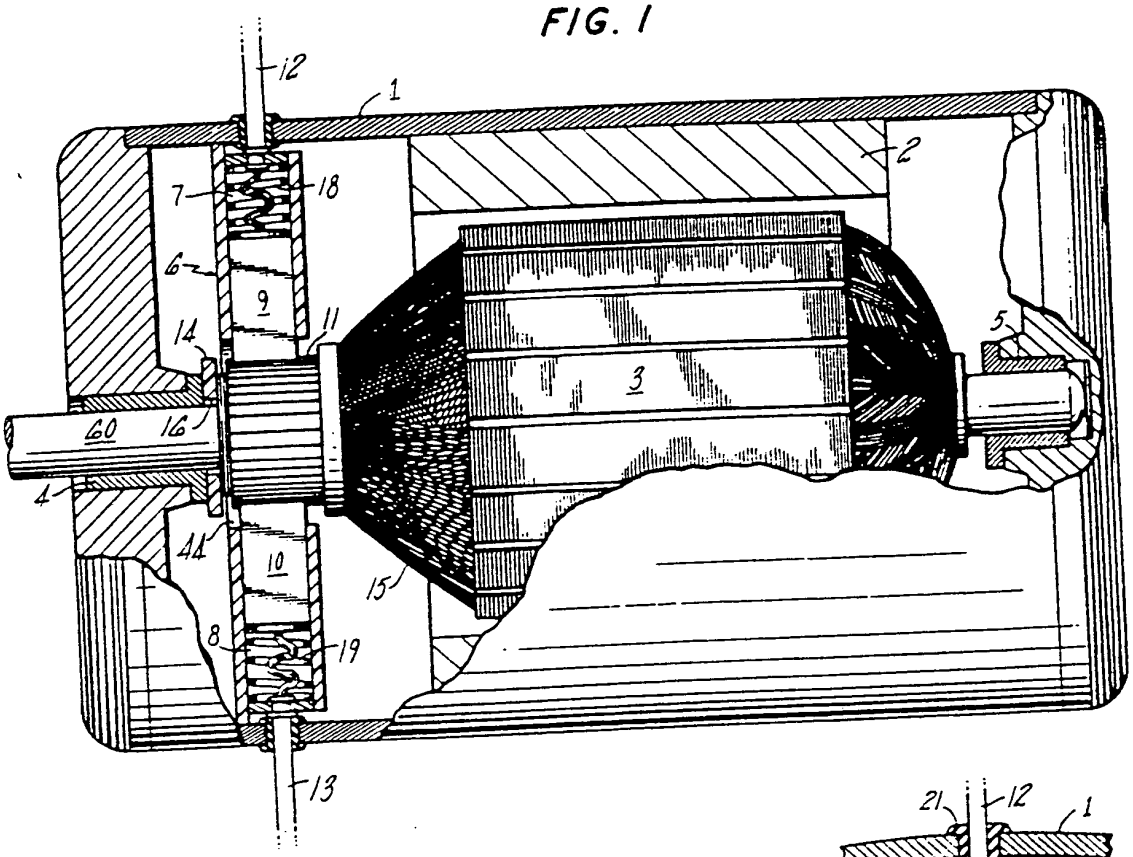
7. Porte-balais pour une machine électrique tournante (1) comportant un rotor (3) comprenant un arbre de rotor et un collecteur (11), ce porte-balais ayant deux logements (7,8) pour recevoir et mettre en position un balai respectif (9,10), et une section déplaçable (14) adaptée de manière à fixer d'une manière libérable les balais (9,10) dans les logements (7,8), dans une position de montage, cette section déplaçable étant placée de manière à être rencontrée par une partie du collecteur (11) pendant l'insertion de l'arbre du rotor à travers le porte-balais, afin de déplacer cette section déplaçable et de libérer les balais (9,10) pour qu'ils viennent en contact avec le collecteur, caractérisé en ce que cette section déplaçable est constituée par deux doigts flexibles (30,31) adaptés de manière à être fléchis lorsque le collecteur vient en contact avec la section déplaçable.

8. Porte-balais suivant la revendication 7 caractérisé en ce que la section déplaçable comprend une saillie (34,36), s'étendant vers l'intérieur, sur les doigts (30,31), cette saillie définissant une surface de contact (32,33) située de manière à retenir les balais (9,10) jusqu'au moment où les doigts (30,31) sont fléchis.

9. Porte-balais suivant l'une quelconque des revendications 1 à 8 caractérisé en ce que ce porte-balais est fabriqué en une matière non conductrice de l'électricité.

10. Porte-balais suivant l'une quelconque des revendications 1 à 9 caractérisé en ce que le porte-balais est constitué par une carte à balais (6,25,29) à laquelle est fixée intégralement la section déplaçable et en ce que les logements (7,8) des balais sont définis par une boîte à balai formée intégralement avec cette carte à balais (6,25,29).

FIG. 1



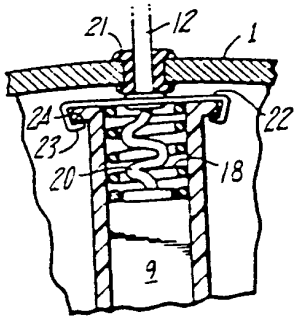


FIG. 7

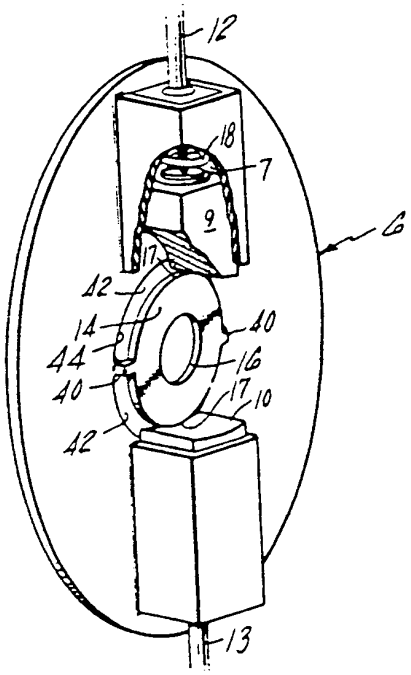
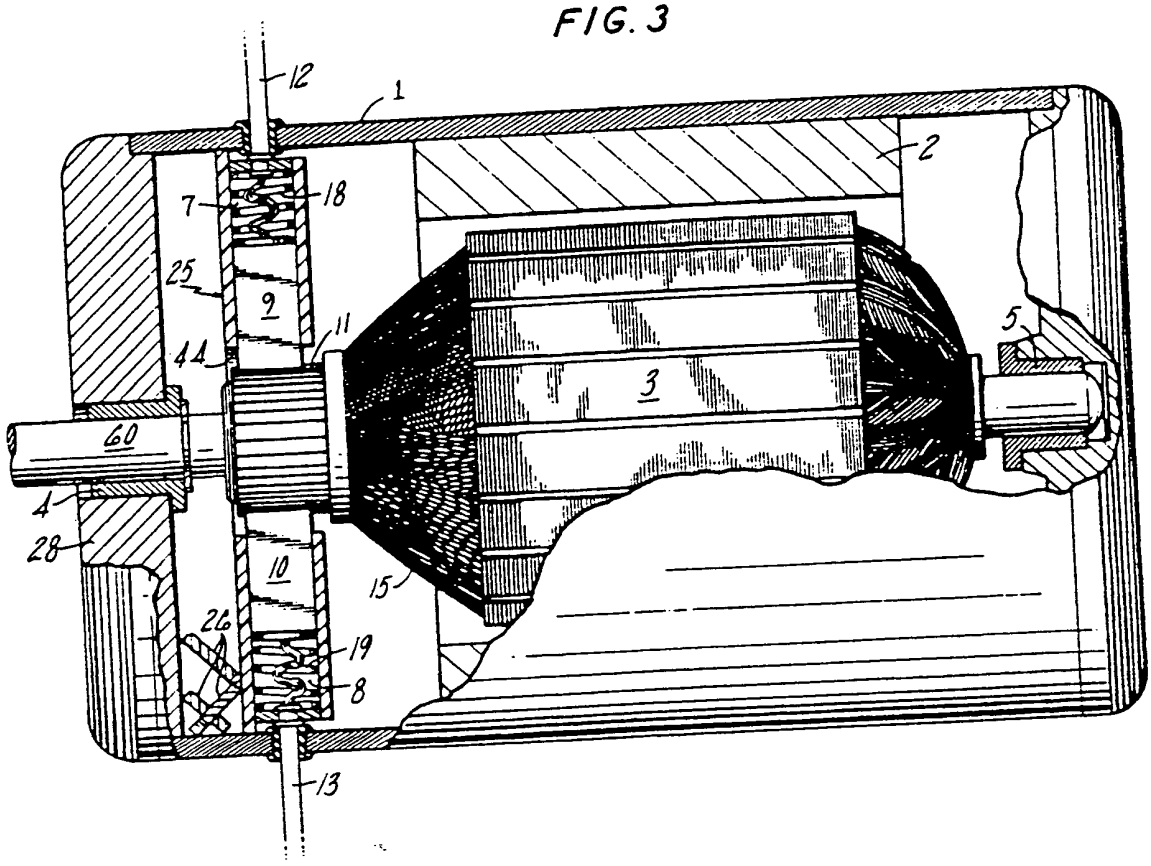


FIG. 2

FIG. 3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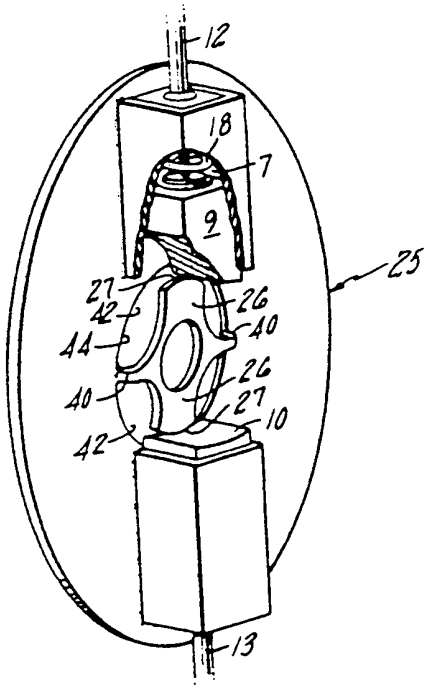
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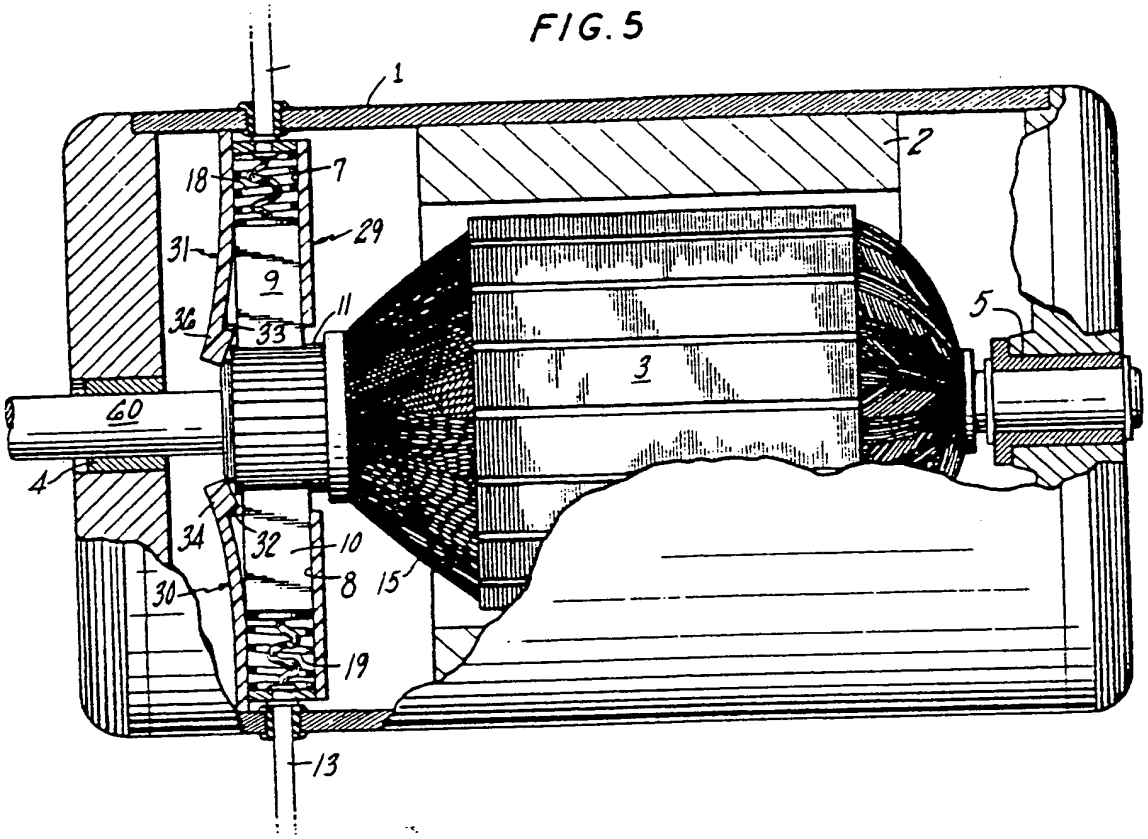
FIG. 4

FIG. 5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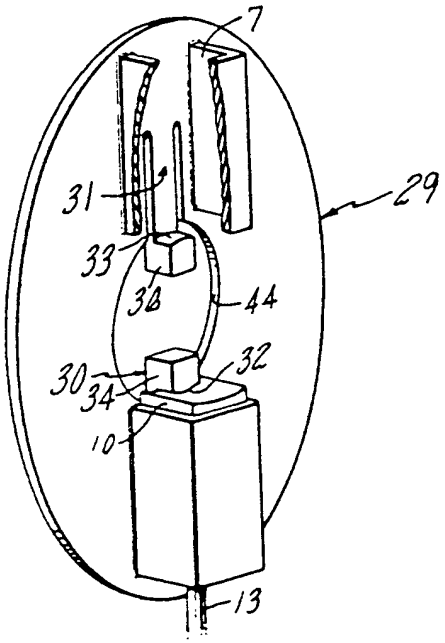
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FIG. 6